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A Guide to the Hierarchical Watershed Coding System for British Columbia

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A GUIDE TO THE
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FOR BRITISH COLUMBIA

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INTRODUCTION

The British Columbia Ministry of Environment and Parks has developed a Watershed Coding System, managed by Water Management Branch, for hierarchical numbering and cataloguing of stream channels and watersheds within the province. The expanded use of this sophisticated file management system now forms part of the computerized file storage and retrieval system for Water, Fisheries and Waste Management programs in British Columbia's Ministry of Environment and Parks. The computerized generation of watershed code numbers has preserved the natural organization, direction and hierarchy of stream channels and tributaries. The numbering system reflects the location of tributary confluences relative to the proportional distance between the mouth and headwaters of the parent stream (i.e., receiving waters).

The system has been developed to catalogue all basins and channels large enough to be depicted on 1:50 000 scale maps. It is usually capable of handling more detail than 1:50 000 but is unable to accomodate detailed mapping at much larger scales (e.g. 1:1 000). Demonstrated applications of the system rarely extend beyond 10 levels (equivalent to a 25-digit code number) although there is provision for up to 14 levels of hierarchy (i.e., a 37-digit code number) to accommodate all channels and basins depicted on 1:50 000 scale maps.

Because some of the examples in this manual are intended for illustrative purposes only, all code numbers should be obtained only from the latest version of the "Watershed Code Dictionary". The dictionary is administered by the Watershed Code Applications Manager, Water Management Branch, Victoria. Further information about watershed code numbers, their theory and application may be obtained from the Watershed Code Applications Manager, telephone number 387-9494.

1. THE WATERSHED CODE NUMBER EXPLAINED

Just as large watersheds consist of basins and sub-basins, the watershed code number consists of a series of sets and sub-sets of numbers reflecting the natural order of channel hierarchy. The 37 digit code number is a 12 set array of numbered levels consisting of one to four digits in each level, as shown in Table 1.

TABLE 1

EXAMPLE OF WATERSHED CODE NUMBER HIERARCHY

123 4 5 6 7 8 9 10 11 12 13 14	Hierarchy Level
129-3604-239-984-995-779-443-945-408-000-000-000	Unnamed Creek, a tributary of
129-3604-239-984-995-779-443-945-000-000-000-000	Hathaway Creek, a tributary of
129-3604-239-984-995-779-443-000-000-000-000-000	Unnamed Creek, a tributary of
129-3604-239-984-995-779-000-000-000-000-000-000	Deka Creek, a tributary of
129-3604-239-984-995-000-000-000-000-000-000-000	Bridge Creek, a tributary of
129-3604-239-984-000-000-000-000-000-000-000-000	Canim Creek, a tributary of
129-3604-239-000-000-000-000-000-000-000-000-000	Mahood River, a tributary of
129-3604-000-000-000-000-000-000-000-000-000-000	Clearwater River, a tributary of
129-0000-000-000-000-000-000-000-000-000-000-000	N. Thompson River, a tributary of
120-0000-000-000-000-000-000-000-000-000-000-000	Thompson River, a tributary of
100-0000-000-000-000-000-000-000-000-000-000-000	Fraser River

The watershed code number may be truncated for manual use by omitting the repetitive zeros, e.g., "129-3604" (Clearwater River) instead of "129-3604-000-000-000-000-000-000-000-000-000-000". Further, the dashes or spaces are used only to simplify the reading of the number and accentuate the sub-sets. Neither dashes nor spaces are necessary for computer use of the code number.

1.1 MAJOR WATERSHEDS (129-NNNN-NNN-NNN- etc.)

The first three digits (e.g., "129") designate the major watershed code. The first digit (first level of hierarchy), divides the province into its eight principal drainages with one arbitrary "coastal" drainage. Figure 1 illustrates these nine drainages. The second digit (second level of hierarchy) designates up to nine of the largest drainages within each major watershed. The coastal group is subdivided into nine arbitrary geographic or administrative groups (south coast rivers, Vancouver Island (East) rivers, Moresby Island, etc.). Similarly, the third digit (third level of hierarchy) is used to designate the largest sub-basin of each of these. The watershed codes for the first three levels of hierarchy in British Columbia's "major" watersheds are illustrated on Figure 2 and listed in Table 2. For clarity, only the largest watersheds are shown in the illustration.

1.2 SUB-WATERSHEDS (NNN-3604-NNN-NNN- etc.)

The next set of four digits designate "sub-watersheds" and represent the fourth level of hierarchy. The tributaries to each trunk stream of a major watershed are proportionately numbered based on the confluence distance from the mouth of the trunk stream to its headwaters. If a sub-watershed tributary mouth is halfway between the mouth and headwaters of the trunk stream, its code number is 5000, three-fourths of the distance, 7500, and so on. The coding system has provision for up to 9999 tributaries of this level to each trunk stream.

All marine islands are coded at the sub-watershed level of hierarchy. Their code reflects an approximate proportional position to the relevant nearby coastline.

TABLE 2

CODE NUMBERS FOR THE MAJOR WATERSHEDS OF BRITISH COLUMBIA

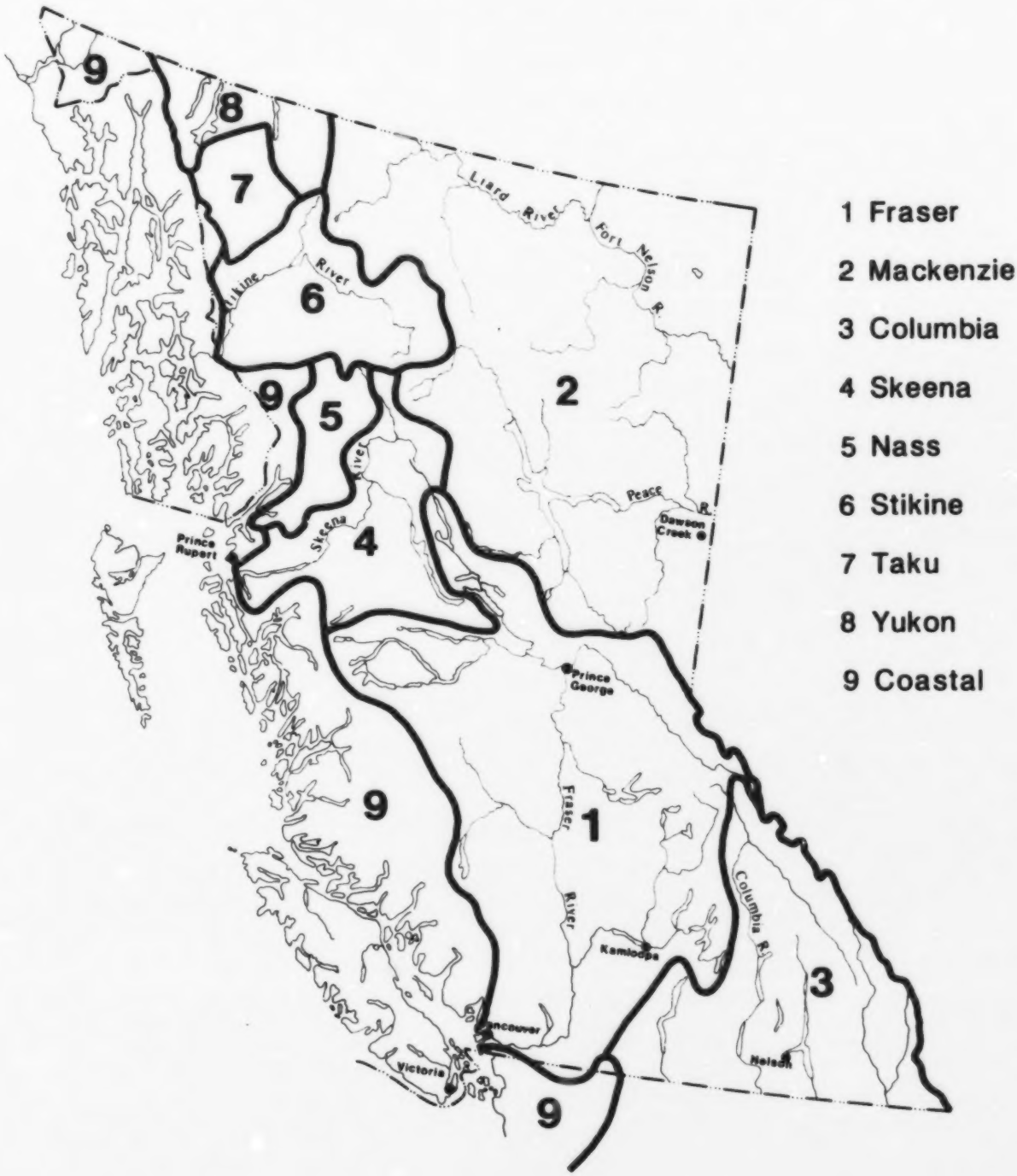
100	Fraser River
110	Harrison River
119	Lillooet River
120	Thompson River
128	South Thompson River
129	North Thompson River
150	Chilcotin River
160	Quesnel River
170	West Road River
180	Nechako River
182	Stuart River
190	McGregor River
200	MacKenzie River
210	Liard River
211	Petitot River
212	Fort Nelson River
213	Beaver River
214	Toad River
215	Coal River
216	Rabbit River
217	Kechika River
218	Dease River
219	Rancheria River
220	Hay River
228	Chinchaga River
230	Peace River
231	Smoky River
232	Kiskatinaw River
233	Beaton River
234	Pine River
235	Halfway River
236	Parsnip River
237	Nation River
238	Omineca River
239	Finlay River
300	Columbia River
310	Okanagan River
320	Kettle River
330	Pend-d'Oreille River
340	Lower Kootenay River
349	Upper Kootenay River
360	Illecillewaet River
370	Canoe River
380	Kicking Horse River
390	Spillimacheen River
400	Skeena River
410	Exchamsiks River
420	Lakelse River
430	Kitsumkalum River
440	Zymoetz River
450	Kitseguecla River
460	Bulkley River
470	Kispiox River
480	Babine River
490	Sustut River
500	Nass River
510	Ishkheenickh River
520	Kinskuch River
530	Cranberry River
540	White River
550	Meziadin River
560	Bell-Irving River
570	Taylor River
580	Damdochax Creek
590	Muskaboo Creek
600	Stikine River
610	Iskut River
620	Chutine River
630	Mess River
640	Tahltan River
650	Tuya River
660	Klastline River
670	Klappan River
680	Pitman River
690	Spatsizi River
700	Taku River
730	Tulsequah River
770	King Salmon Creek
780	Inklin River
782	Yeth Creek
785	Sutlahine Creek
787	Kowatua Creek
788	Nahlin River
789	Sheslay River
790	Nakina River

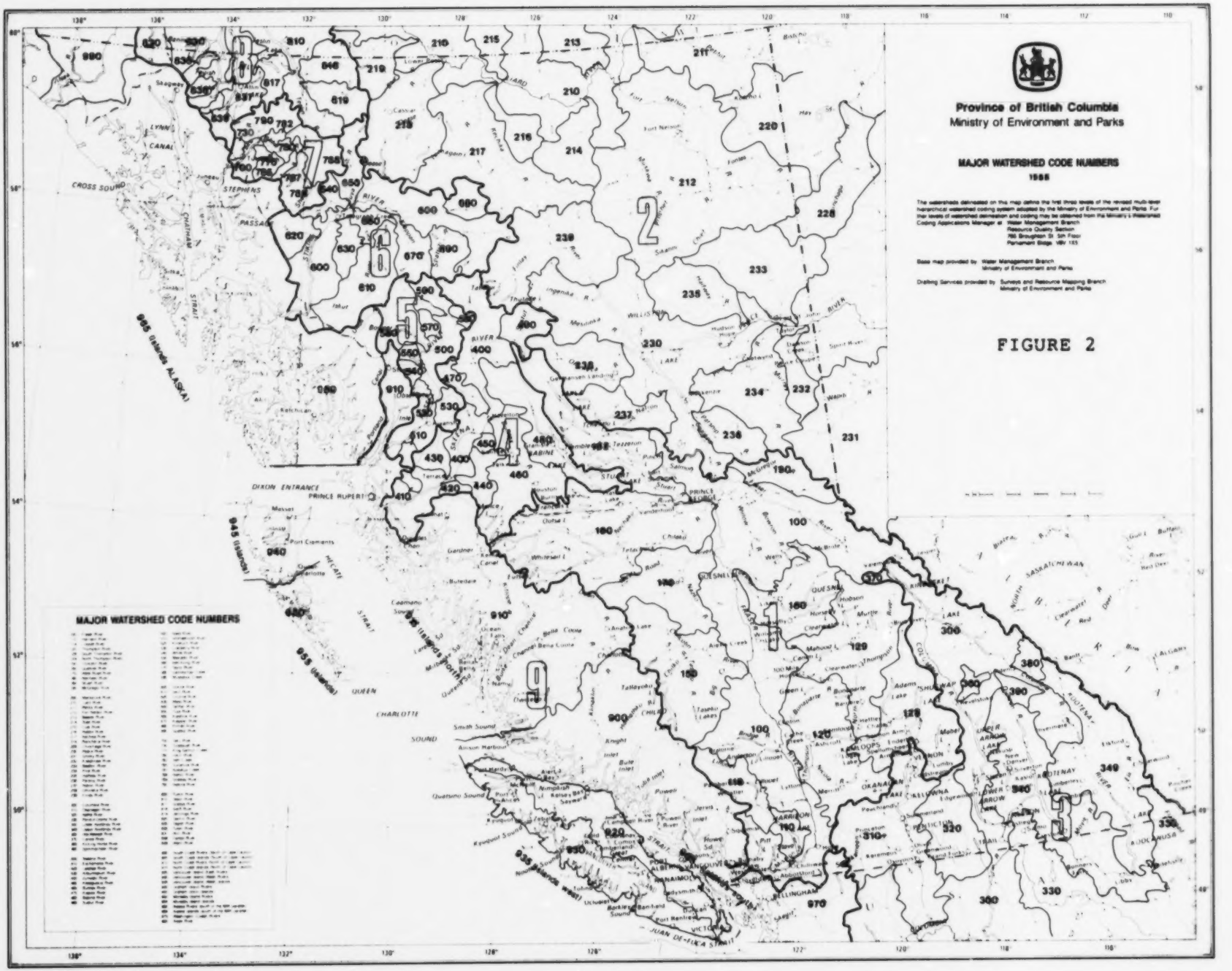
TABLE 2 (Continued)

CODE NUMBERS FOR THE MAJOR WATERSHEDS OF BRITISH COLUMBIA

800	Yukon River
810	Teslin River
817	Gladys River
818	Swift River
819	Jennings River
820	Takhini River
830	Tagish River
836	Tutshi River
837	Atlin River
838	Fantail River
839	Wann River
900	South Coast Rivers (south of Cape Caution)
905	South Coast Islands (south of Cape Caution)
910	North Coast Rivers (north of Cape Caution)
915	North Coast Islands (north of Cape Caution)
920	Vancouver Island (East) Rivers
925	Vancouver Island (East) Gulf Islands
930	Vancouver Island (West) Rivers
935	Vancouver Island (West) Islands
940	Graham Island Rivers
945	Graham Island Islands
950	Moresby Island Rivers
955	Moresby Island Islands
960	Alaska Rivers (south of the 60th parallel)
965	Alaska Islands (south of the 60th parallel)
970	Washington (Coast) Rivers
990	Alsek River

FIGURE I. THE NINE INITIAL WATERSHED DIVISIONS OF BRITISH COLUMBIA




Province of British Columbia
Ministry of Environment and Parks
MAJOR WATERSHED CODE NUMBERS
1988
FIGURE 2
MAJOR WATERSHED CODE NUMBERS
DIXON ENTRANCE
PRINCE RUPERT
CROSS SOUND
STEPHENS PASSAGE
CHATHAM STRAIT
QUEEN CHARLOTTE SOUND
HECATE STRAIT
JUAN DE FUCA STRAIT
PRINCE GEORGE
QUESNEL
KAMLOOPS
VERNON
KELOWNA
PENTICTON
NELSON
CRANBROOK
KIMBERLEY
ROSSLAND
TRAIL
PRINCE RUPERT
VANCOUVER
VICTORIA
NANAIMO
PORT ALBERNI
CAMPBELL RIVER
PORT HARDY
WILLISTON LAKE
FORT NELSON
DAWSON CREEK
FORT ST JOHN
MACKENZIE
TERRACE
KITIMAT
SMITHERS
HOUSTON
BURNS LAKE
FORT ST JAMES
QUESNEL
WILLIAMS LAKE
100 MILE HOUSE
CLEARWATER
BARRIERE
CHASE
SALMON ARM
REVELSTOKE
GOLDEN
INVERMERE
CRANBROOK
KIMBERLEY
CASTLEGAR
GRAND FORKS
PRINCETON
HOPE
CHILLIWACK
ABBOTSFORD
MISSION
PORT COQUITLAM
NEW WESTMINSTER
RICHMOND
DELTA
SURREY
WHITE ROCK
LANGLEY
PORT MOODY
BURNABY
NORTH VANCOUVER
WEST VANCOUVER
SQUAMISH
WHISTLER
PEMBERTON
LILLOOET
LYTTON
MERRITT
PENTICTON
OLIVER
OSOYOOS
GRAND FORKS
TRAIL
ROSSLAND
NELSON
CRESTON
FERNIE
SPARWOOD
ELKFORD
CRANBROOK
KIMBERLEY
INVERMERE
GOLDEN
REVELSTOKE
SALMON ARM
VERNON
KELOWNA
PENTICTON
OLIVER
OSOYOOS
KAMLOOPS
MERRITT
LYTTON
LILLOOET
PEMBERTON
WHISTLER
SQUAMISH
NORTH VANCOUVER
WEST VANCOUVER
PORT MOODY
BURNABY
NEW WESTMINSTER
PORT COQUITLAM
MISSION
ABBOTSFORD
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PENTICTON
OLIVER
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KAMLOOPS
MERRITT
LYTTON
LILLOOET
PEMBERTON
WHISTLER
SQUAMISH
NORTH VANCOUVER
WEST VANCOUVER
PORT MOODY
BURNABY
NEW WESTMINSTER
PORT COQUITLAM
MISSION
ABBOTSFORD
CHILLIWACK
HOPE
PRINCETON

1.3 MINOR WATERSHEDS (NNN-NNNN-239-984 etc.)

The next ten sets of three digit numbers (hierarchy levels five to 14), designate "minor" watersheds. The code number of these tributaries is determined in the same manner as sub-watersheds. Thus, tributaries near the mouth have low numbers whereas tributaries further upstream have proportionately higher numbers. Further, stream mouths which are geographically proximal have similar code numbers. From the list in Table 5 on page 28, for example, it is apparent that Lloyd Creek 129-0082-518 is geographically and numerically upstream of Cold Creek 129-0082-265 and downstream of the unnamed creek, 129-0082-931. The coding system has provision for up to 999 tributaries in each of these "minor" hierarchy levels.

2. GENERATING WATERSHED CODES

The generation of watershed codes is an iterative process. The development of the British Columbia watershed code listing first required the creation of the major watershed code numbers, then the generation of sub-watershed code numbers and so on. The code number for a channel's receiving waters must exist before the tributaries of that channel can be coded. The sub-watersheds for priority basins are being coded so that further sub-divisions in minor watershed hierarchy levels can be made.

2.1 GENERATING SUB-WATERSHED CODES

The generation of watershed codes begins with coastline, marine island and channel preparation on 1:50 000 topographic mapsheets. These prepared maps, which will be periodically updated with recent editions, are the basis for all digitizing, proportionate distance calculation and generation of watershed code numbers.

Sub-watershed code numbers are assigned to all tributaries emptying directly into any of the major watersheds or directly into the sea from the Mainland, Vancouver Island, Graham Island or Moresby Island. Lesser marine islands are also designated by a sub-watershed code number (e.g., 905-2500 Texada Island).

Sub-watershed code numbers are generated by measuring (by digitizing) the entire length of a major watershed channel (e.g., Fraser River 100) as depicted on 1:50 000 topographic maps and assigning the code number according to the proportionate distance of the sub-watershed's confluence from the mouth of the major watershed channel.

For coastal drainages, the coastline substitutes for the major watershed channel and the proportionate distance of the sub-watershed's mouth to the total coastline length is used. Because the coastlines of Graham and Moresby Islands form a closed circle, watersheds 940-0001 and 950-0001 are

adjacent to 940-9999 and 950-9999 respectively. This anomaly occurs with watershed code numbers of all marine islands (ref. section 2.9 - marine islands) except Vancouver Island. Table 3 describes the coastline segments used to determine coastal sub-watershed code numbers.

TABLE 3

START LOCATIONS FOR MEASURMENT OF COASTLINES AND COASTAL SUB-WATERSHED CODE NUMBER DESIGNATION

Watershed Code No.	Watershed Name	Direction From Start	Start Location	Finish Location
900*	south coast rivers	northerly	49°N. (near Blaine)	Cape Caution
905	south coast islands	northerly	Church Point	Cape Caution
910	north coast rivers	northerly	Cape Caution	Hyder, B.C.
915	north coast islands	northerly	Cape Caution	Hyder, B.C.
920	Vancouver Island (East) rivers	northerly	Church Point	Cape Scott
930	Vancouver Island (West) rivers	northerly	Church Point	Cape Scott
935	Vancouver Island (West) islands	northerly	Church Point	Cape Scott
940	Graham Island rivers	clockwise	Rose Spit	Rose Spit
945	Graham Island islands	clockwise	Rose Spit	Rose Spit
950	Moresby Island rivers	clockwise	Spit Point	Spit Point
960	Alaska rivers	northerly	Hyder, Alaska	60°N
965	Alaska islands	northerly	Hyder, Alaska	60°N
970	Washington rivers	southerly	49°N (near Blaine, WA)	46°15'N**

*Including Point Roberts, WA
**Mouth of Columbia River, WA, U.S.A.

2.2 TRANS-BOUNDARY TRIBUTARIES

Because boundaries are often defined for administrative rather than topographic reasons, watershed coding problems may occur where boundaries sub-divide basins. Wherever possible, the watershed coding system ignores administrative boundaries and catalogues all basins which have any part of a basin within British Columbia. Trans-boundary tributary code numbers

reflect the proportionality of the parent stream channel length as if the border were non-existent. However, some arbitrary decisions are necessary for more complex systems which meander in and out of British Columbia.

A moderately complex example illustrated on Figure 3 with the corresponding abbreviated dictionary report, Table 4, can be explained as follows. The watershed code numbers for Skagit River, 970-1100, and the tributary Lightning Creek, 970-1100-705 reflect the proportionality of the location of their mouths relative to the lengths of the state of Washington coastline and Skagit River respectively (e.g., 1/10th and 3/4ths the distance). The distance upstream, recorded as "0", corresponds to the start of the digitizing at the intersection of both streams and the U.S./British Columbia international boundary. The code numbers for both pairs of tributaries to the Skagit River and Lightning Creek reflect the proportionality of the parent stream channel length as if the U.S.A./British Columbia border did not exist.

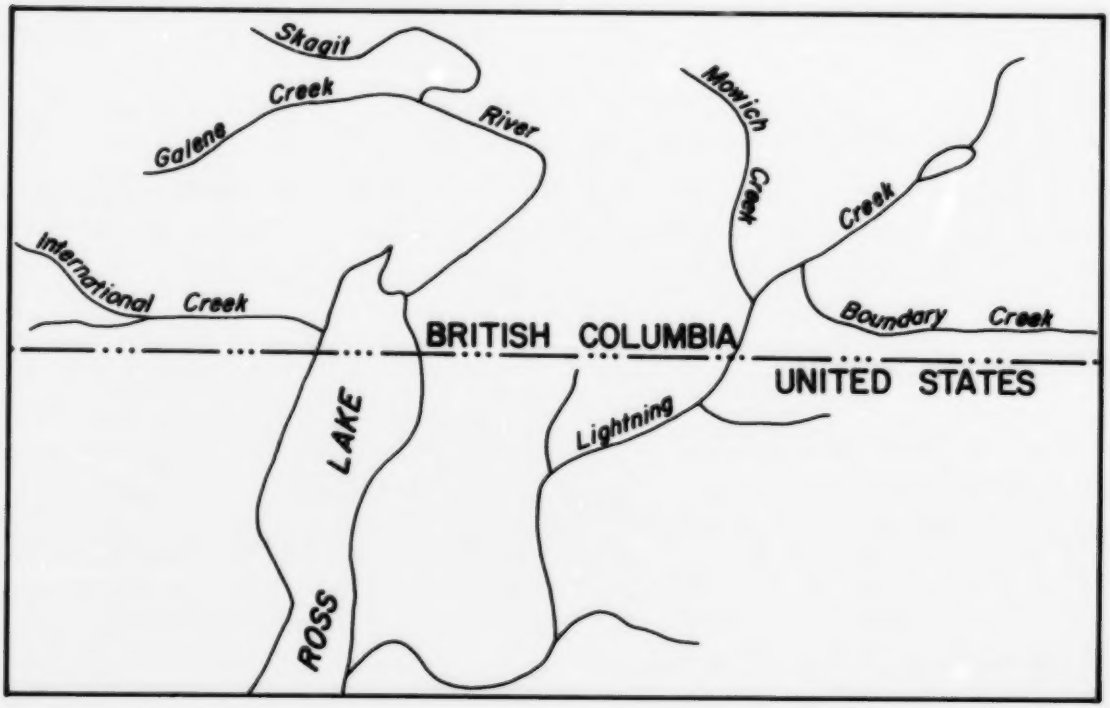


FIGURE 3. TRANS-BOUNDARY TRIBUTARIES: AN EXAMPLE

TABLE 4

TRANS-BOUNDARY TRIBUTARY CODE NUMBERING:AN EXAMPLE

Watershed Code	Name	Distance Upstream (m) (on parent stream, from U.S. border)
970-1100	Skagit River	0
970-1100-705	Lightning Creek	0
970-1100-705-710	Mowick Creek	285
970-1100-705-721	Boundary Creek	776
970-1100-776	International Creek	76
970-1100-803	Galene Creek	7330

2.3 MULTIPLE MOUTH TRIBUTARIES

Tributaries that have multiple mouths are coded by the location of the largest mapped channel, or if equal, by a central mouth.

2.4 TRIBUTARIES TO SIDE CHANNELS

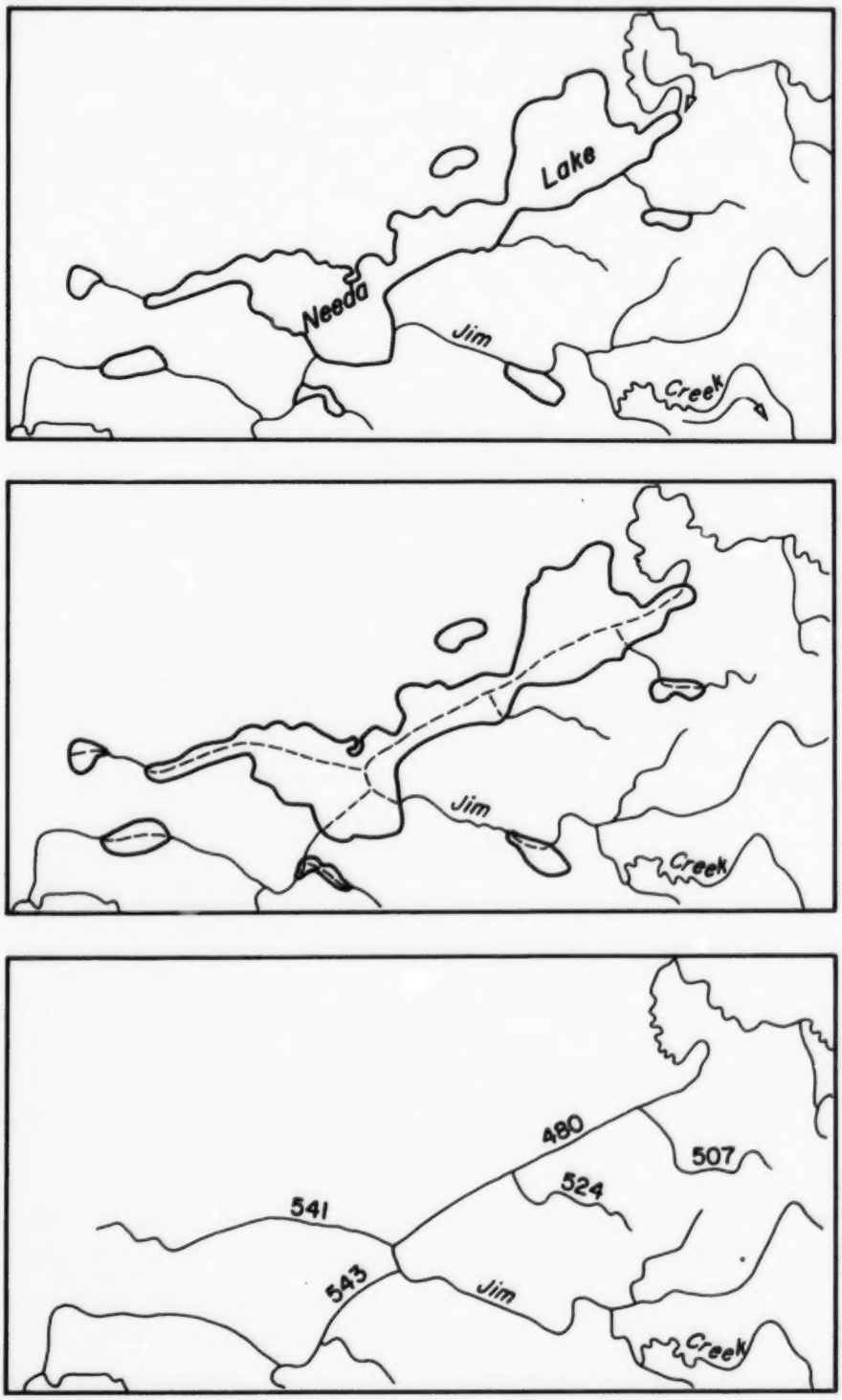
For the purposes of coding, the side channel of a trunk stream is largely ignored and the tributary mouth located as if the side channel were the trunk stream. In situations where the side channel is mapped as functionally the lower reach of a tributary, the tributary is coded as if its mouth were located at the outlet of the side channel.

2.5 OPPOSITE BANK TRIBUTARIES

Tributaries that are mapped as intersecting a receiving channel directly opposite one another have the same location and distance upstream. They are differentiated by designating the right bank tributary's code number an increment higher than the left, e.g., NNN-NNNN-789 (left bank tributary) and NNN-NNNN-790 (right bank tributary). Right bank/left bank is determined by facing downstream.

2.6 TRIBUTARIES TO LAKES AND LAKE ARMS

Whenever possible, lakes are considered as a widening in the channel for coding purposes. Tributary confluences are measured and coded as if they were tributaries to a single channel through the center of the water body. Figure 4 illustrates this principle. In lakes with complex shapes, more elaborate arbitrary construction lines may be required to maintain the logic of upstream/downstream hierarchy progression and distance upstream. Figure 5 illustrates this less frequent problem.



ACTUAL MAPPING CONFIGURATION

MAP PREPARATION CONFIGURATION

CODED AS IF IN THIS CONFIGURATION

FIGURE 4. CODING TRIBUTARIES TO A LAKE

(Actual watershed code numbers from the Dictionary have been abbreviated for illustrative purposes).

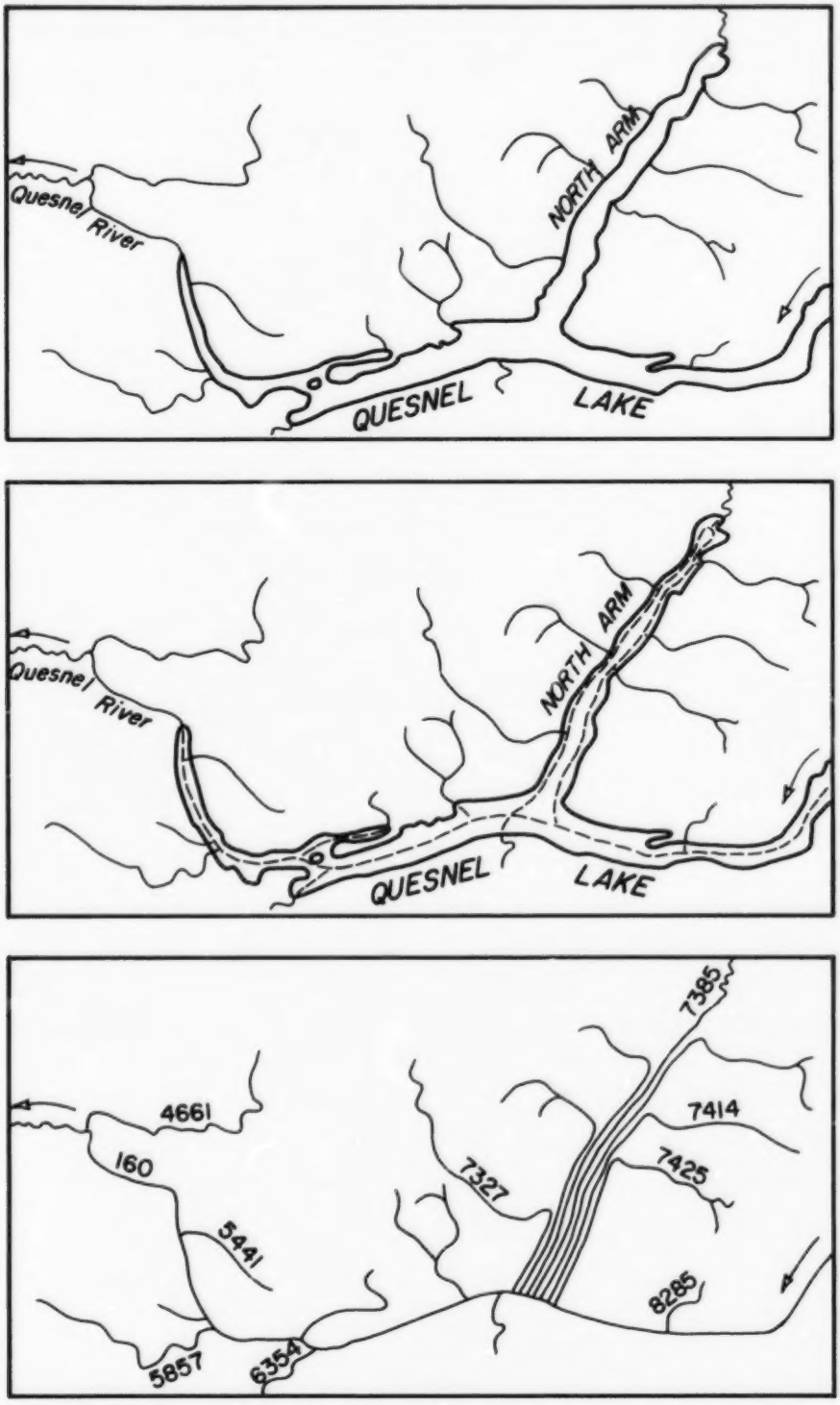


FIGURE 5. CODING TRIBUTARIES TO A MULTI-BASIN OR COMPLEX LAKE

(Actual watershed code numbers from the Dictionary have been abbreviated for illustrative purposes).

2.7 TRIBUTARIES TO TIDAL WATERS AND RESERVOIRS

Receiving waters which have widely fluctuating levels such as tidal waters and some reservoirs may present special problems because of the apparent change in mouth location of their tributaries. Coding tributaries according to low water levels may result in some confluences or levels of hierarchy being different than would be observed at higher water levels. The water level depicted on current 1:50 000 maps is customarily used as the basis for determining hierarchy and confluence location. However, ancilliary maps and air photos may be used in instances where more detailed knowledge is required to resolve ambiguities.

2.8 INTERNAL DRAINAGE SYSTEMS

Sub-basins containing internal or "closed" drainages (i.e., having no mapped outlet - except to groundwater or evaporation) are coded as if tributary to the nearest logical trunk stream based on contour interpretation (Figure 6). An important application of the watershed coding system, this serves to locate less extensive drainages within the appropriate larger basin containing them.

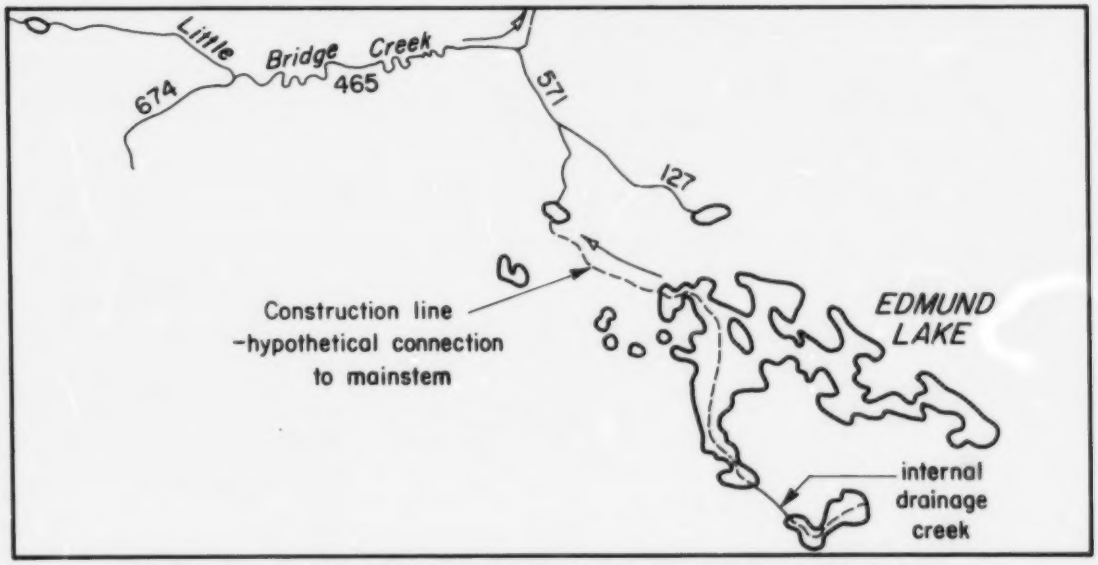


FIGURE 6. ASSIGNING WATERSHED CODES TO INTERNAL DRAINAGES (Actual watershed code numbers from the Dictionary have been abbreviated for illustrative purposes only).

2.9 MARINE ISLANDS

All islands along the British Columbia coastline except Vancouver Island, Graham Island and Moresby Island are coded at the sub-watershed level (e.g. NNN-1234-NNN-NNN etc.). The first digit, "9" indicates the coastal major watershed group, the second digit indicates the nearest associated land mass, and the third digit, "5" indicates marine islands. There is provision for up to 9999 marine islands associated with each land mass. Table 2 lists the major watershed code numbers for the marine islands.

Coding of marine islands follows the proportionate rule only approximately because of the necessity to accomodate lateral island associations (as compared to the generally linear arrangements of channels). The islands do, however, follow the general proportional distance along their associated coastline. Islands along the south and north coasts and along Vancouver Island's coast are numbered south to north. Those associated with Graham and Moresby Islands are numbered clockwise beginning at Rose Spit and Spit Point, respectively.

All named and unnamed islands that have at least one mapped water body or stream have been assigned a sub-watershed code number. The code number for a marine island is assigned by interpolating its position relative to an adjacent previously numbered stream on the relevant coastline.

Because marine islands are coded at the "sub-watershed" level, all channels and basins on them are minor watersheds (i.e., levels 5 to 14). Channels on marine islands are numbered according to their proportionate distance clockwise around the island's coastline from an arbitrary start-point. However, because an island's coastline is a closed circle, watersheds 001 and 999 (5th level only) are adjacent to each other at the island coastline measurement start/stop location.

The start/stop location is usually assigned to a prominent (preferably named) shore landmark near the southern end of the island, e.g. Upwood Point at the southern end of Texada Island. The coastline is measured (digitized) in a clockwise direction from this point and code numbers assigned proportionately. Figure 7 illustrates a typical numbering example. In cases where an appropriate landmark is not available, coastline measurement starts/ finishes at the southernmost extent of the island.

2.10 FRESHWATER ISLAND CHANNELS

Islands in rivers and lakes are located within a larger watershed and surrounded by water which has both direction and flow whereas marine islands are a watershed tributary directly to the sea. Therefore, channels on inland islands are coded as if tributary to a logical bank or lakeshore of the appropriate system. The island *per se* is not numbered but its channels are numbered.

The watershed code number for freshwater island channels is determined by the proportionate distance of the channel confluence from the mouth of its receiving waters, the same as any other tributary to the receiving waters. Because the receiving water flow has direction, island channels are numbered in downstream/upstream order, not clockwise or in a south to north direction as are marine islands. Figure 8 illustrates a typical example of watershed code numbering for freshwater island channels.

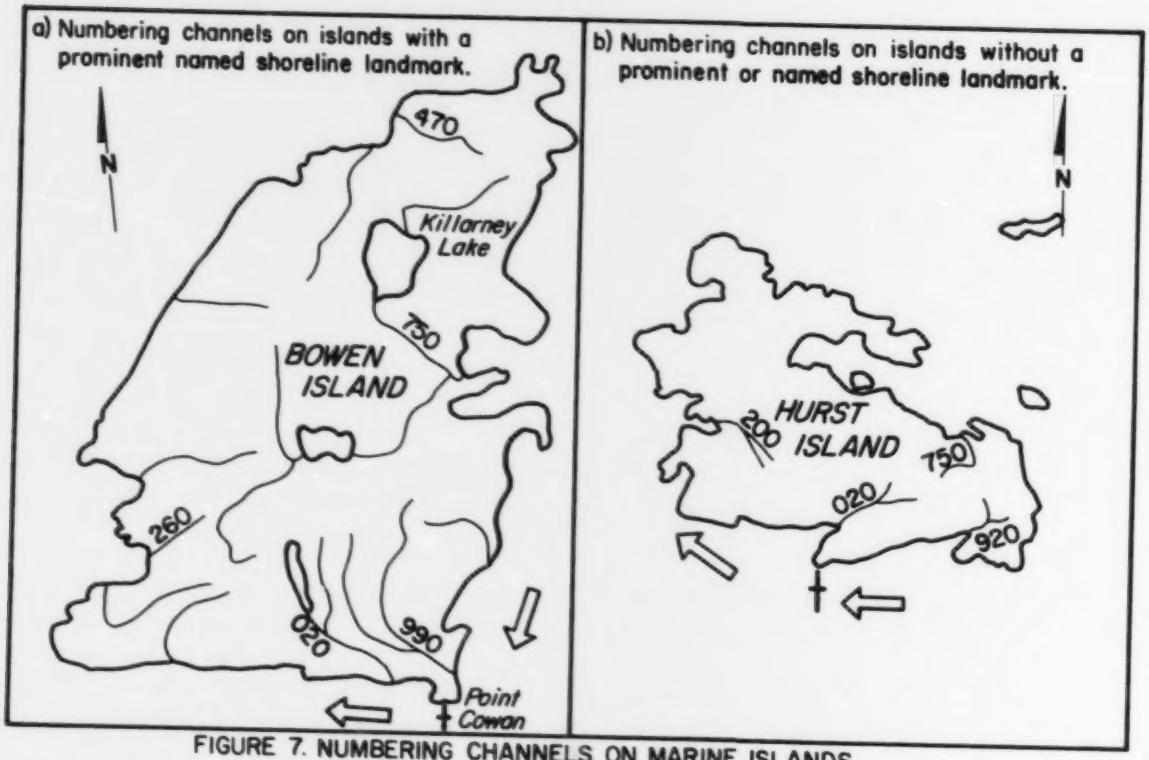


FIGURE 7. NUMBERING CHANNELS ON MARINE ISLANDS.
(Actual watershed code numbers from the Dictionary have been abbreviated for illustration purposes only).

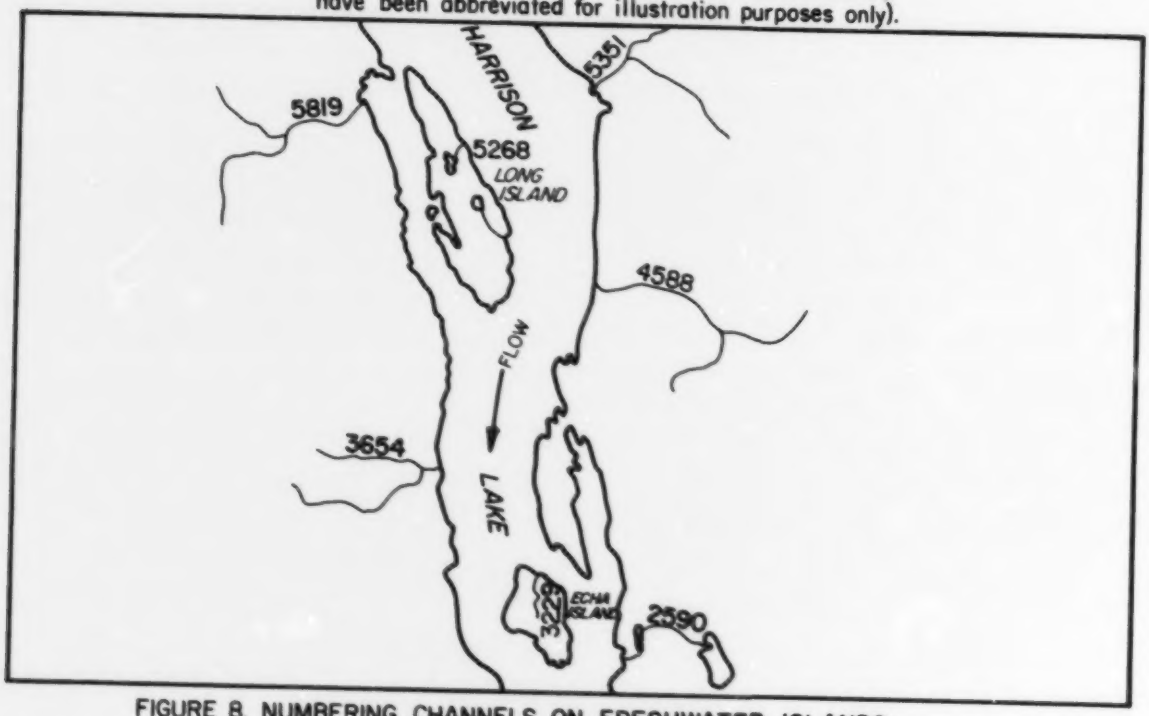


FIGURE 8. NUMBERING CHANNELS ON FRESHWATER ISLANDS
(Actual watershed code numbers from the Dictionary have been abbreviated for illustrative purposes only).

3. PRECAUTIONS

Certain precautions must be observed when creating codes or using the watershed coding system. Most problems occur because of scale and channel diversions. Areas of changing water levels (major seasonal fluctuations) and wide multiple-channel floodplains also present special problems.

3.1 CAVEATS OF SCALE

Because the hierarchical watershed coding system has been standardized on 1:50 000 contour base maps, attempting to accomodate excessive detail within the system will create problems. The system will work well at increased levels of scale and detail only in areas of low drainage density such as the mountainous regions of the province but will not accomodate extensive dendritic drainage patterns at comparable increased scales. Dendritic drainage patterns are found in naturally greater detail on the fine-textured soils of the Great Plains and on larger scale mapping in areas of extensive drainage and irrigation ditching.

It is recommended that the coding system be modified for sorting drainage information that cannot be depicted on a 1:50 000 scale map. The basic method for assigning code numbers can still be used to structure the file system, but the detailed drainage networks (or intensive drainage site locations) can be stored and manipulated as a sub-set or module of the main file.

Photographically reducing or enlarging a map will change its presentation scale, but not the scale of its information, i.e., its level of detail. Increasing scale (e.g., from 1:50 000 to 1:20 000) usually increases the measured distance along a channel because of the increased detail presented - an increase in the number of channel curves portrayed. Although the relative position of a tributary's mouth may not change significantly, changes will probably be noted in the distance of the mouth of the trunk stream to the tributary, elevation, latitude and longitude, and UTM coordin-

ates of the confluence. Similar differences would also be noted in smaller scale (e.g., 1:250 000) maps as they tend to underestimate channel lengths. Figure 9 illustrates the apparent difference in measured channel length and location caused by mapping at different scales. The hierarchical watershed coding system has been standardized on published 1:50 000 topographic maps. The channel length measured for the purpose of assigning watershed codes is the length of the channel as shown on these maps. Because more detailed maps not only show an increase in pattern detail and drainage density, 1:50 000 scale watershed codes may not be able to accomodate the higher number of tributary channels as shown on large scale (e.g., 1:1 000) maps. Figure 9 illustrates drainage density differences derived from different mapping scales but presented at the same scale for easier comparison.

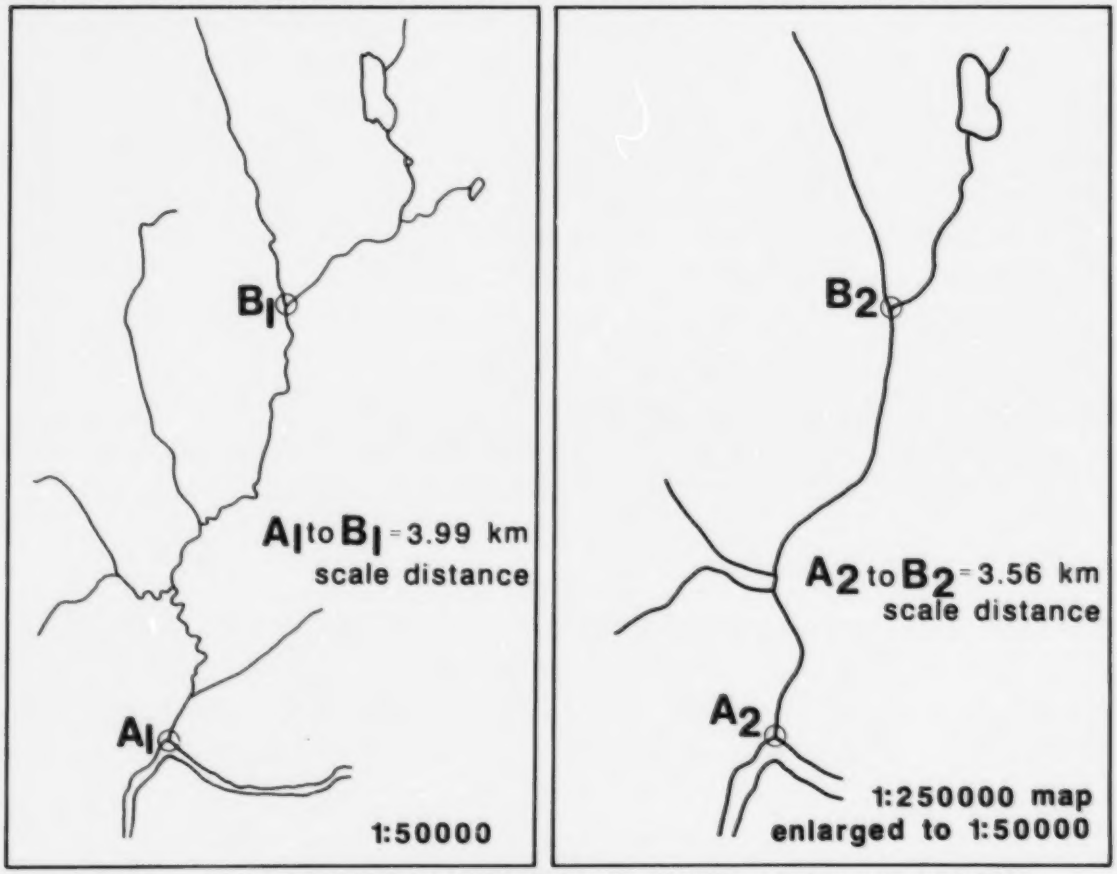


FIGURE 9. SCALE-DEPENDENT DIFFERENCES IN CHANNEL LENGTH AND LOCATION 1:50 000 and 1:250 000 MAPPING SCALE ADJUSTED TO THE SAME PRESENTATION SCALE

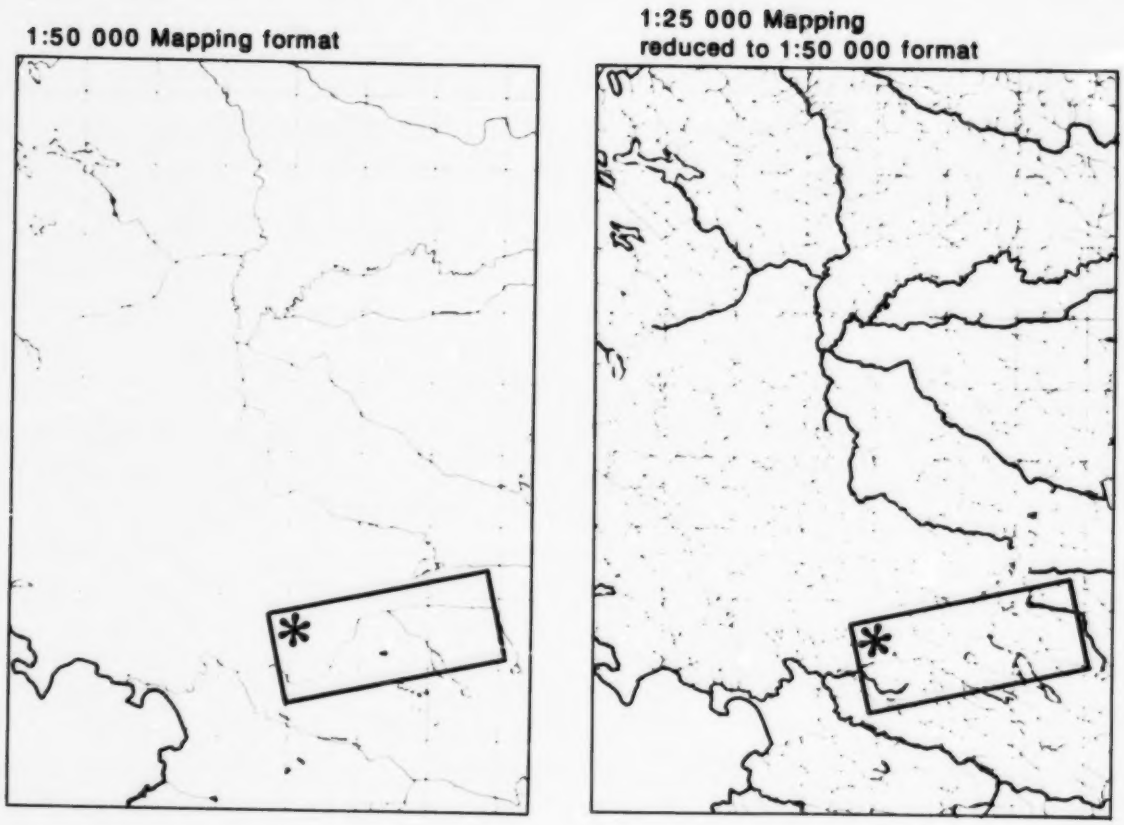


FIGURE 10. SCALE-DEPENDENT DIFFERENCES IN DRAINAGE DENSITY

Streams and lakes on a 1:50 000 scale topographic map (left) compared to a map compiled at 1:25 000 (right) from interpretation of 1:15 840 aerial photographs. The channel elements common to both maps have been highlighted. *Note the differences in drainage as well as density (adapted from: Gimbarzevsky, P. 1978. Integrated Survey of Biophysical Resources in National Parks. Forest Management Institute, Canadian Forestry Service, Ottawa. 21 pp.).

3.2 MULTIPLE GAZETTED NAMES

Some rivers have different names for different sections of the same channel, usually reflecting historic travel patterns or trade routes. Because the watershed coding system is based on landscape and river processes, it largely ignores these name changes and lists the trunk as a compound name in the dictionary. The use of compound gazetted names in the dictionary will be minimized and restricted to situations where, for no apparent mapped or geographical reason, the gazetted name of the river changes. The Cottonwood/Swift River system (NTS reference: 93G/1) is a good example.

3.3 DESIGNATED HEADWATERS

For the purposes of coding and measuring channel distances, there are a number of situations which require that a system have a designated or arbitrarily assigned headwater. For example, the Thompson River (Figure 11) which "originates" from the simultaneous confluence of two large tributaries, has its headwater designated at the confluence of the North and South Thompson Rivers.

A designated headwater may be used to subdivide major watersheds (at the three digit code level). For example, the Kootenay River has been arbitrarily subdivided into the "Lower" Kootenay (340) and "Upper" Kootenay (349) Rivers at Libby Dam in the U.S.A. This conveniently separates the West and East Kootenay geographic regions and drainage basins.

A designated headwater also may be used at the upper end of a lake or reservoir to substitute for the lack of a large channel extending through the lake. Rather than choosing one of the several similarly-sized tributaries to Thutade Lake, the headwaters of the Finlay River is designated as the upper end of Thutade Lake (Figure 12).

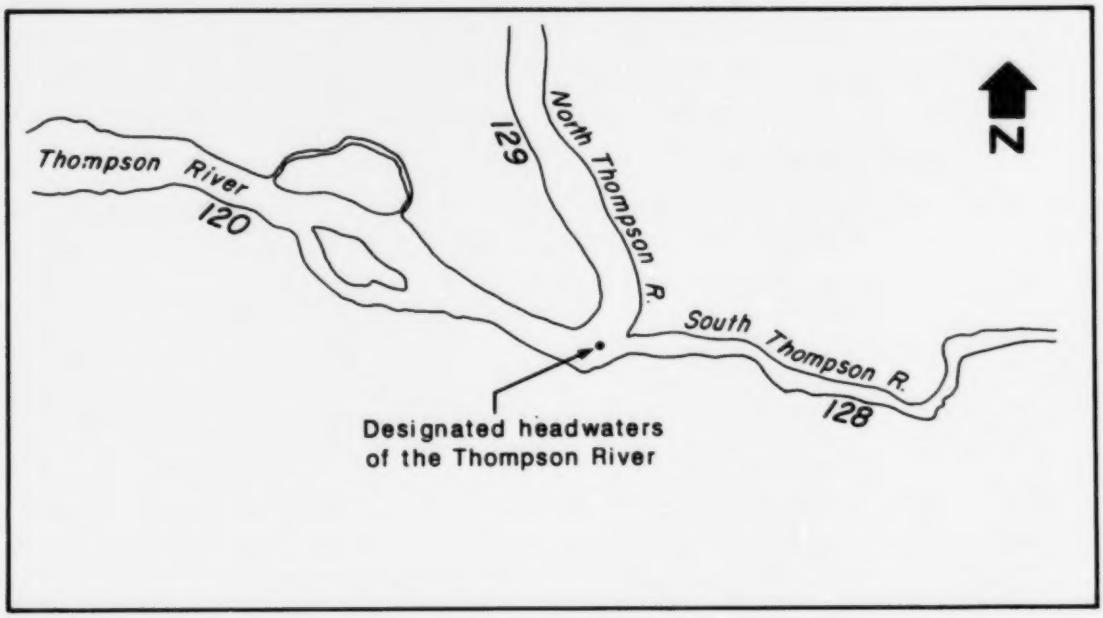


FIGURE 11. DESIGNATED HEADWATERS: THOMPSON RIVER AT NORTH THOMPSON/SOUTH THOMPSON CONFLUENCE

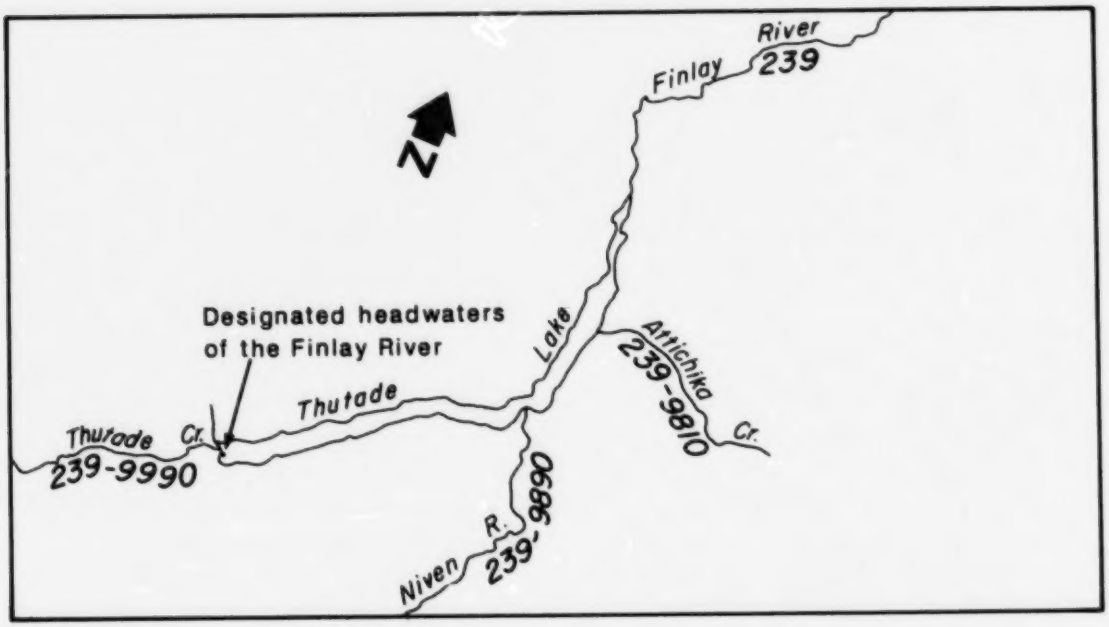


FIGURE 12. DESIGNATED HEADWATERS: FINLAY RIVER AT THUTADE LAKE
(Abbreviated watershed code numbers used in example are for illustrative purposes only)

3.4 DIVERSIONS

Large interbasin water diversions can replace topographically controlled drainages with engineering works. Wherever possible, the natural drainage pattern as depicted on current 1:50 000 NTS maps is used for the purpose of watershed coding. Annotations concerning various diversions are applied to the prepared map base and these diversions are treated as a new tributary to the appropriate receiving water.

4. THE DICTIONARY

The computer-generated watershed code numbers are catalogued in the Watershed Code Dictionary. This dictionary, which is available to any user who has access to the Ministry of Environment and Parks VAX, can be queried from any VAX terminal to obtain various reports or data files for subsequent data manipulation. The access routines are documented in the Watershed Code Dictionary System User Manual available from Computing Services Branch, Ministry of Environment and Parks.

4.1 ORGANIZATION

The catalogue of watersheds is contained within the Watershed Code Dictionary. Watershed codes are linked to the gazetted name of channels, marine islands and water bodies (lakes, reservoirs etc.). Names of marine islands are listed analogically to channel names whereas names of waterbodies correspond to the watershed that contains them. If the gazetted name (G) is unavailable then the primary alias name (A) may be used; otherwise the channel, marine island or waterbody name is left blank. Two main functions are provided by the general user access routines:

a) reporting of the dictionary on a user supplied Watershed Code or name, and
b) querying the dictionary for Watershed Codes, given a name.

The reporting function will have options to sort the report in various sequences (i.e., number or name) and to view the report on terminal screen or produce a hard copy printed version. The query function will contain the option to produce a report from the Watershed Codes, once determined.

4.2 SAMPLE LISTINGS

Watershed code dictionary reports similar to the example listings of Table 5 and Table 6 can be generated for desired watersheds. These reports

TABLE 5

SAMPLE STREAM REPORT FROM THE WATERSHED CODE DICTIONARY

Date: 8- 5-87 Page: 1

Ministry of Environment and Parks - Water Management Branch

Watershed Code Dictionary Report

Stream Report Sorted by Watershed Code

Watershed Code	Name	NTS	Zn-Easting-Northing	Distance Upstream (m)
129-0000-000-000-000-000-000-000-000-000-000-000	(G) NORTH THOMPSON RIVER	92I09	10-687810-5617476	0
0082-000-000-000-000-000-000-000-000-000-000	(G) PAUL CREEK	92I09	10-686966-5620155	2961
070-000-000-000-000-000-000-000-000-000		92I09	10-689842-5620955	3219
100-000-000-000-000-000-000-000-000-000		92I09	10-691108-5621292	4581
138-000-000-000-000-000-000-000-000-000		92I09	10-692217-5622114	6287
143-000-000-000-000-000-000-000-000-000		92I09	10-692343-5622346	6552
265-000-000-000-000-000-000-000-000-000	(G) COLD CREEK	92I09	10-697011-5623723	12073
274-000-000-000-000-000-000-000-000-000		92I09	10-697374-5623711	12488
282-000-000-000-000-000-000-000-000-000		92I09	10-697679-5623944	12877
452-000-000-000-000-000-000-000-000-000		92I09	10-704476-5624931	20597
469-000-000-000-000-000-000-000-000-000		92I09	10-705265-5624971	21392
518-000-000-000-000-000-000-000-000-000	(G) LLOYD CREEK	92I09	10-707267-5624562	23596
790-000-000-000-000-000-000-000-000-000		82L12	11-292444-5624969	35984
883-000-000-000-000-000-000-000-000-000		82L13	11-290789-5627781	40220
931-000-000-000-000-000-000-000-000-000		82L13	11-291562-5629538	42434
0143-000-000-000-000-000-000-000-000-000		92I09	10-686723-5622343	5172
0153-000-000-000-000-000-000-000-000-000		92I09	10-686693-5622724	5554
0178-000-000-000-000-000-000-000-000-000		92I09	10-686629-5623600	6434
0182-000-000-000-000-000-000-000-000-000		92I09	10-686660-5623737	6573
0373-000-000-000-000-000-000-000-000-000		92I16	10-688634-5630046	13480
0491-000-000-000-000-000-000-000-000-000		92I16	10-690385-5632676	17722
0524-000-000-000-000-000-000-000-000-000	(G) DAIRY CREEK	92I16	10-689609-5633332	18926
613-000-000-000-000-000-000-000-000-000		92I16	10-683354-5635979	7821
619-000-000-000-000-000-000-000-000-000		92I16	10-683275-5635988	7900
0579-000-000-000-000-000-000-000-000-000	(G) LANES CREEK	92I16	10-690773-5634844	20895
368-000-000-000-000-000-000-000-000-000		92I16	10-687414-5637978	4906
590-000-000-000-000-000-000-000-000-000	(G) McCAULEY CREEK	92I16	10-685172-5639806	7874
900-000-000-000-000-000-000-000-000-000		92I16	10-681711-5639586	12006
0591-000-000-000-000-000-000-000-000-000	(G) ROBBINS CREEK	92I16	10-690992-5635231	21341
134-000-000-000-000-000-000-000-000-000	(G) SEVEN O CREEK	92I16	10-691992-5634656	1179
417-000-000-000-000-000-000-000-000-000		92I16	10-693858-5635731	3668
0701-000-000-000-000-000-000-000-000-000	(G) HEFFLEY CREEK	92I16	10-692120-5637855	25316
128-000-000-000-000-000-000-000-000-000		92I16	10-694686-5638498	2976
295-000-000-000-000-000-000-000-000-000	(G) EDWARDS CREEK	92I16	10-698174-5637568	6819
556-000-000-000-000-000-000-000-000-000		92I16	10-703596-5636718	12833
602-000-000-000-000-000-000-000-000-000		92I16	10-704569-5636386	13896
725-000-000-000-000-000-000-000-000-000		92I16	10-706880-5634970	16732
776-000-000-000-000-000-000-000-000-000		92I16	10-707968-5634784	17911
782-000-000-000-000-000-000-000-000-000	(G) ARMOUR CREEK	92I16	10-708005-5634636	18064
884-000-000-000-000-000-000-000-000-000		92I16	10-708064-5632407	20423
0767-000-000-000-000-000-000-000-000-000	(G) JAMIESON CREEK	92I16	10-692692-5639785	27708
107-000-000-000-000-000-000-000-000-000		92I16	10-689780-5641308	3699
167-000-000-000-000-000-000-000-000-000	(G) VENN CREEK	92I16	10-688569-5642798	5739
190-000-000-000-000-000-000-000-000-000		92I16	10-688343-5643513	6537
257-000-000-000-000-000-000-000-000-000	(G) RUSHTON CREEK	92I16	10-688181-5645683	8840
274-000-000-000-000-000-000-000-000-000		92I16	10-688259-5646220	9411

TABLE 6

SAMPLE LAKE REPORT FROM THE WATERSHED CODE DICTIONARY

Date: 8-7-87 Page: 1

Ministry of Environment and Parks - Water Management Branch

Watershed Code Dictionary Report

Lake Report Sorted by Watershed Code

Watershed Code	Lake Seq	Name	NTS	Zn-Easting-Northing	Distance Upstream (m)
129-0082-000-000-000-000-000-000-000-000-000-000	1	(G) PAUL LAKE	92I09	10-700548-5624119	16520
0082-000-000-000-000-000-000-000-000-000-000	2	(G) PINANTAN LAKE	92I09	10-709555-5623310	26499
0082-000-000-000-000-000-000-000-000-000-000	3		92I09	10-711040-5623194	28315
0082-000-000-000-000-000-000-000-000-000-000	4	(G) PEMBERTON LAKE	82L13	11-291254-5629202	41974
0082-000-000-000-000-000-000-000-000-000-000	5	(G) HYAS LAKE	82L13	11-291434-5630437	43601
0701-000-000-000-000-000-000-000-000-000-000	1	(G) LITTLE HEFFLEY LAKE	92I16	10-703446-5636703	12681
0701-000-000-000-000-000-000-000-000-000-000	2	(G) HEFFLEY LAKE	92I16	10-704312-5636454	13631
0701-000-000-000-000-000-000-000-000-000-000	3	(G) ANDY LAKE	92I16	10-709025-5630905	22319
0767-000-000-000-000-000-000-000-000-000-000	1		92P01	10-680332-5658989	33208
0767-000-000-000-000-000-000-000-000-000-000	2	(G) REA LAKE	92P01	10-680053-5658805	33564
0951-000-000-000-000-000-000-000-000-000-000	1	(G) SULLIVAN LAKE	92I16	10-702228-5648573	12870
0951-000-000-000-000-000-000-000-000-000-000	2	(G) KNOUFF LAKE	92I16	10-702111-5651959	16459
1402-000-000-000-000-000-000-000-000-000-000	1	(G) WHITEWOOD LAKE	92P01	10-686254-5663612	9883
1485-000-000-000-000-000-000-000-000-000-000	1		92P01	10-691509-5673678	14760
1485-000-000-000-000-000-000-000-000-000-000	2	(G) TOTUNKWA LAKE	92P01	10-687129-5674428	21126
1485-000-000-000-000-000-000-000-000-000-000	3		92P01	10-687377-5675334	22204
1485-000-000-000-000-000-000-000-000-000-000	4		92P01	10-687966-5675554	22969
1553-000-000-000-000-000-000-000-000-000-000	1	(G) BADGER LAKE	92P01	10-700717-5658555	6556
1643-000-000-000-000-000-000-000-000-000-000	1	(G) MARTIN MEADOWS LAKE	92P01	10-701980-5660188	5854
1752-000-000-000-000-000-000-000-000-000-000	1		82L13	11-294526-5631181	53547
1752-000-000-000-000-000-000-000-000-000-000	2	(G) EILEEN LAKE	82L13	11-294645-5630958	53857
1752-000-000-000-000-000-000-000-000-000-000	3		82L13	11-295115-5630134	54870
1752-000-000-000-000-000-000-000-000-000-000	4		82L13	11-295087-5628290	57078
1752-000-000-000-000-000-000-000-000-000-000	5		82L13	11-294858-5627615	57873
1901-000-000-000-000-000-000-000-000-000-000	1		82M04	11-293209-5680567	19821
1901-000-000-000-000-000-000-000-000-000-000	2		82M04	11-293458-5680099	20704
1901-000-000-000-000-000-000-000-000-000-000	3		82M04	11-294946-5680538	23138
1901-000-000-000-000-000-000-000-000-000-000	4	(G) NORTH BARRIERE LAKE	82M05	11-298773-5688735	37151
1901-000-000-000-000-000-000-000-000-000-000	5	(G) SASKUM LAKE	82M05	11-312479-5697499	58996
1936-000-000-000-000-000-000-000-000-000-000	1	(G) CAMP NINE LAKE	92P01	10-698139-5672154	2066
1936-000-000-000-000-000-000-000-000-000-000	2		92P01	10-697105-5669969	4665
2000-000-000-000-000-000-000-000-000-000-000	1	(G) ALLAN LAKE	92P01	10-686286-5678565	17676
2000-000-000-000-000-000-000-000-000-000-000	2		92P01	10-682771-5676876	22116
2000-000-000-000-000-000-000-000-000-000-000	3	(G) HOOPATATKWA LAKE	92P01	10-678249-5675104	27918
2000-000-000-000-000-000-000-000-000-000-000	4	(G) TWIN LAKE	92P01	10-675355-5674685	33694
2418-000-000-000-000-000-000-000-000-000-000	1		92P08	10-698129-5688724	472
2455-000-000-000-000-000-000-000-000-000-000	1	(G) MULHOLLAND LAKE	92P08	10-688820-5686562	10759
2455-000-000-000-000-000-000-000-000-000-000	2	(G) SMITH LAKE	92P08	10-688158-5686720	11454
2455-000-000-000-000-000-000-000-000-000-000	3		92P08	10-685639-5690195	16949
2455-000-000-000-000-000-000-000-000-000-000	4		92P08	10-684194-5692277	20218
2455-000-000-000-000-000-000-000-000-000-000	5	(G) PATRICK LAKE	92P08	10-683396-5692619	21138
2546-000-000-000-000-000-000-000-000-000-000	1		92P08	10-707927-5690838	13795
2667-000-000-000-000-000-000-000-000-000-000	1		92P08	10-683767-5697820	15196
2667-000-000-000-000-000-000-000-000-000-000	2	(G) THUYA LAKE (LOWER)	92P08	10-683628-5697856	15343
2667-000-000-000-000-000-000-000-000-000-000	3	(G) THUYA LAKE (UPPER)	92P08	10-683507-5698418	16021
2667-000-000-000-000-000-000-000-000-000-000	4		92P08	10-682338-5699463	17732

are placed in a temporary file to allow the user the flexibility of several display options or to move the report file to another system for further manipulation and longer storage.

4.3 CROSS-REFERENCING TO OLD DICTIONARY

The Ministry of Environment and Parks has developed a Watershed Code Cross-Reference system which provides the means of linking the codes generated in the current Watershed Code Dictionary with the codes from the old dictionary. The methodology for generating the codes in the old dictionary originated with the Resource Analysis Branch (Shera and Grant, 1980). Watershed code numbers from the old dictionary, which always begin with a two digit major watershed code group, are easily distinguished from code numbers of the new dictionary because they begin with a three digit group. Also, the hierarchical cataloguing has been expanded from 8 numeric levels (21 digits) to 14 numeric levels (37 digits) in the new dictionary.

The cross-reference dictionary, in the form of an OLD-NEW look-up table, will eventually replace the old dictionary.

4.4 ADDING WATERSHED CODE NUMBERS

A "skeleton" dictionary which catalogues all watersheds to approximately the fifth numeric code level is being developed to provide the framework for the entire province. Additional codes will be added as need arises until, ultimately, the dictionary contains watershed code numbers for all channels depicted on 1:50 000 NTS maps. Some new codes will be additions from areas able to accommodate more detailed mapping.

Ref.: Shera, W.P. and Grant, D.J. 1980. A Hierarchical Watershed Coding System for British Columbia. Resource Analysis Branch Tech. Paper 3. B.C. Ministry of Environment, Victoria. 22 pp.

The two main reasons for adding watershed code numbers to the dictionary are as follows:

a) code numbers are required for channels depicted on 1:50 000 NTS maps but not yet in the dictionary, and
b) insertion of channels derived from greater scale or not depicted on 1:50 000 NTS maps.

The Water Management Program maintains the Watershed Code Dictionary on behalf of the B.C. Ministry of Environment and Parks and all requests for dictionary additions are made through the Watershed Code Applications Manager, Water Management Branch, Victoria.

Requests for additional coding of channels not previously digitized must be accompanied with details of the area covered, preferably by indicating the area on the appropriate map with a list of channel names. Requests for additional coding of channels not depicted on the 1:50 000 map base requires that each confluence location be precisely indicated on a 1:50 000 map. The watershed code number of previously unnumbered tributaries or tributaries not depicted on the 1:50 000 map base along a channel or coastline will be determined by interpolating their locations according to distances between two previously coded tributaries. The original digitized distances are maintained as the basis for the new channel's code numbers so that the dictionary continues to reflect the 1:50 000 map base proportional distances.

4.5 CHANGING WATERSHED CODE NUMBERS

Because of the widespread use of the B.C. Hierarchical Watershed Coding System, changes to any given code number are to be avoided, if possible. Unless proposed changes are significant, they will not be made, e.g., minor differences in distance measurements constitute insufficient reason to change a code number. However, valid reasons for changing an existing watershed number include:

a) the channel/basin was incorrectly identified as to location or hierarchy (a base map or digitizing error),
b) the channel has been diverted into a different receiving basin.

Channel names can be more easily changed for the following reasons:

a) the name shown on the base map is incorrect (the occasional error in toponymy),
b) an authorized name change has been made in the Gazetteer of British Columbia, e.g., a previously unnamed channel has had a proposed name accepted by the "Canadian Permanent Committee on Geographic Names" (contact: Toponomy Unit, Surveys and Resource Mapping Branch, Victoria).

Requests for a change in a watershed code number or channel name must include the following information:

a) existing code number or channel name,
b) reason for change,
c) proposed new code number or channel name,
d) NTS mapsheet and edition number as source.

Requests for changes are to be made through the Watershed Code Applications Manager, Water Management Branch, Victoria. The merits of change requests will be reviewed for acceptability by representatives of affected programs.

5. APPLICATIONS

The Ministry of Environment and Parks Hierarchical Watershed Coding System has been developed and is being used to store and retrieve data about the watersheds of B.C. Originally designed to organize data collected at a reconnaissance scale inventory (i.e., the B.C. Aquatic Data Base), the system can accommodate any information associated with a basin and is equally applicable to manual files. With the expanded 14 levels of basin hierarchy, the system sufficiently catalogues all channels and basins large enough to be depicted on current 1:50 000 scale topographic maps. The dictionary data base, which contains such elements as the start NTS mapsheet number, UTM coordinates and distance upstream in meters to the mouth or outlet for all streams, channels, coastlines, marine islands and fresh water bodies whether gazetted, unnamed or aliased, is available in a variety of report formats. The Watershed Coding System will form one of the major components of the WMB Water Information System. It will also be used to provide additional cross-referencing of Ministry information contained within the SEAM data base and the Water License Information Management System by way of the Ministry's geo-referenced Point of Interest Data Base.